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# THE DEVONIAN SECTION NEAR ALTOONA, PENNSYLVANIA<sup>†</sup>

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## STRATIGRAPHY

*Introduction.*—This joint article has grown out of work done in connection with the geologic survey of the Ebensburg quadrangle, which is about 5 miles west of Altoona. Fig. 1 shows the location of the section of the state, and Fig. 2 shows in greater detail the area studied and the location of the profile section, Fig. 2. The rocks of the greater part of the Devonian section of the region are very well exposed along the Pennsylvania Railroad west of Altoona, and along the New Portage branch of the same west of Hollidaysburg. They strike about N. 40° E., and dip regularly to the northwest with a uniformly diminishing degree. Only one fault of any consequence is known. It is shown in the profile section, Fig. 2. The downthrow is apparently 100 feet to the east.

In previous surveys of this region it was recognized that the mass of shale and thin sandstones between the Oriskany sandstone below and the bottom of the Catskill above represents the Marcellus, Hamilton, Genesee, Nunda (Portage), and Chemung formations; yet, on account of the generally homogeneous character of the mass as a whole, no effort was made to discriminate and map the individual formations. It has been found possible, however, by taking careful note of the lithologic and paleontologic characters of the rocks, to identify the main formations recognized in New York state, and to establish and map the limits of the same with a fair degree of precision, as will appear in the following description. The section described in this paper then consists of the Oriskany sandstone, the Marcellus shale, the Hamilton formation, the Genesee shale, and the Nunda, Chemung, and Catskill formations. With the exception of the Marcellus, which is not certainly known at Altoona, the above mentioned formations are shown in the profile section, Fig. 2. The section begins at the intersection of Seventeenth Street

<sup>†</sup> Published by Permission of the Director U. S. Geological Survey.

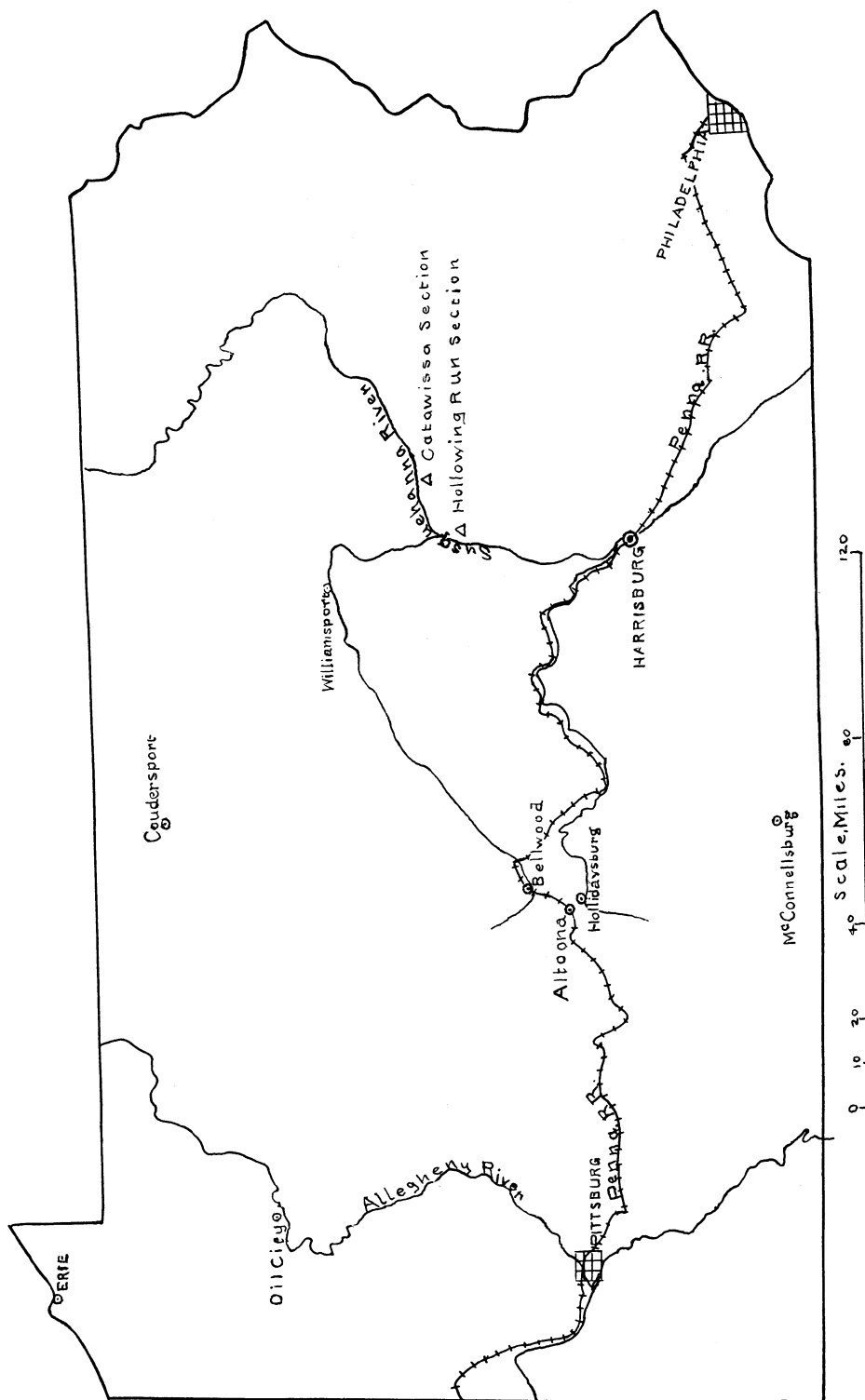


FIG. 1

and Second Avenue, Altoona, extends thence northwestward to the Pennsylvania Railroad at a point 1,425 feet west of the Logan House and then follows the track to Kittanning Point. (See Fig. 3.) At the base of the section the Lewistown limestone of the Second Geological Survey of Pennsylvania<sup>1</sup> is exposed.

*Oriskany sandstone.*—This is thick bedded, generally coarse-grained, gray or buff siliceous rock. The thickness seen did not exceed 20 feet, and apparently it is not over 50 feet thick anywhere in the region. Boulders of this sandstone lie along the Pennsylvania Railroad track about 1 mile southwest of Bellwood, having slid down from the outcrop on the hillside above. From these boulders the fossils given in the first list on a succeeding page were collected.

In Altoona an outcrop of Oriskany was observed in an alley just east of Fourteenth Street and between Third and Fourth Avenues. At this outcrop, which is shown on the profile section, the weathered rock is buff, fine-grained, and apparently argillaceous. It contains the fauna of the second list beyond.

At Duncansville, southwest of Altoona, the Oriskany is exposed in a railroad cut and is thick-bedded and siliceous. (See Fig. 4.)

*Marcellus shale.*—The Marcellus shale follows the Oriskany sandstone directly in this section, the Onondaga limestone of the New York sections being absent as in all of the Allegheny sections south of New York. So far as it can be identified, it is a black, highly fissile, clay shale. It is certainly known only in a railroad cut about 1 mile southwest of Bellwood. At that point about 20 feet of the formation are exposed. Here the Marcellus shale apparently underlies the Oriskany sandstones, since the rocks are overturned and dip to the southeast. In Altoona, shale showing in a thin outcrop on Seventeenth Street near Third Avenue, and dipping 55° to the southeast may be Marcellus, but there is no positive evidence that it is.

*Hamilton formation.*—The Hamilton formation is predominately a very dark green clay shale, which weathers to a dull brown or blackish color, and breaks up in weathering or under the hammer obliquely to the bedding planes into very irregularly shaped pieces. In addition to such rock, there is more or less shale approaching olive-green and gray tints, and also dark green sandy and slightly

<sup>1</sup> Report T on Blair County, by Franklin Pratt.

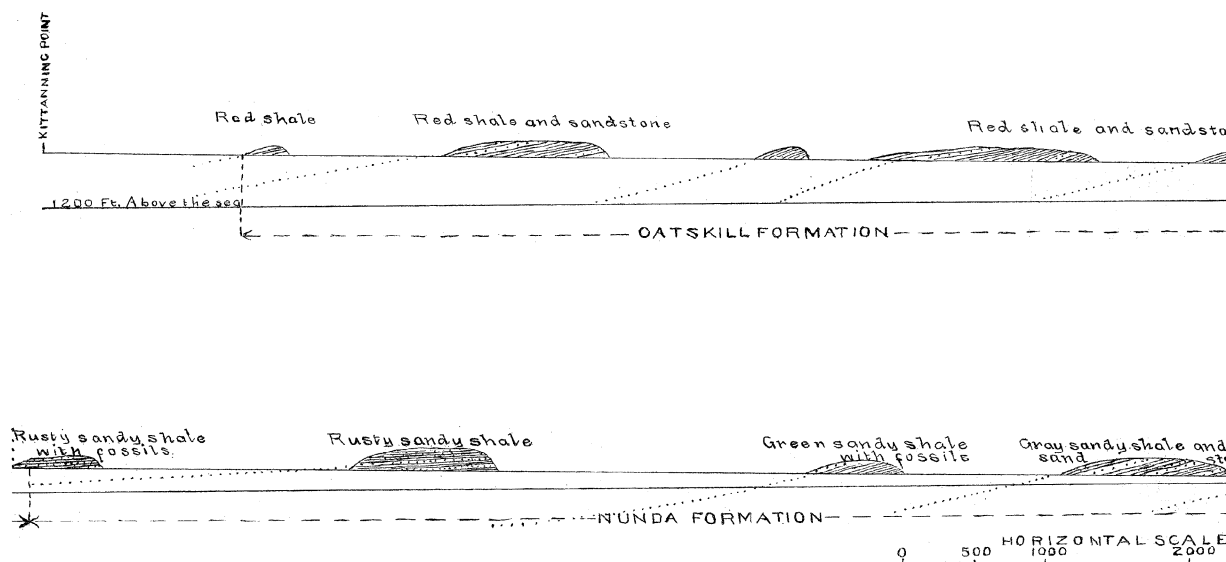


FIG. 2

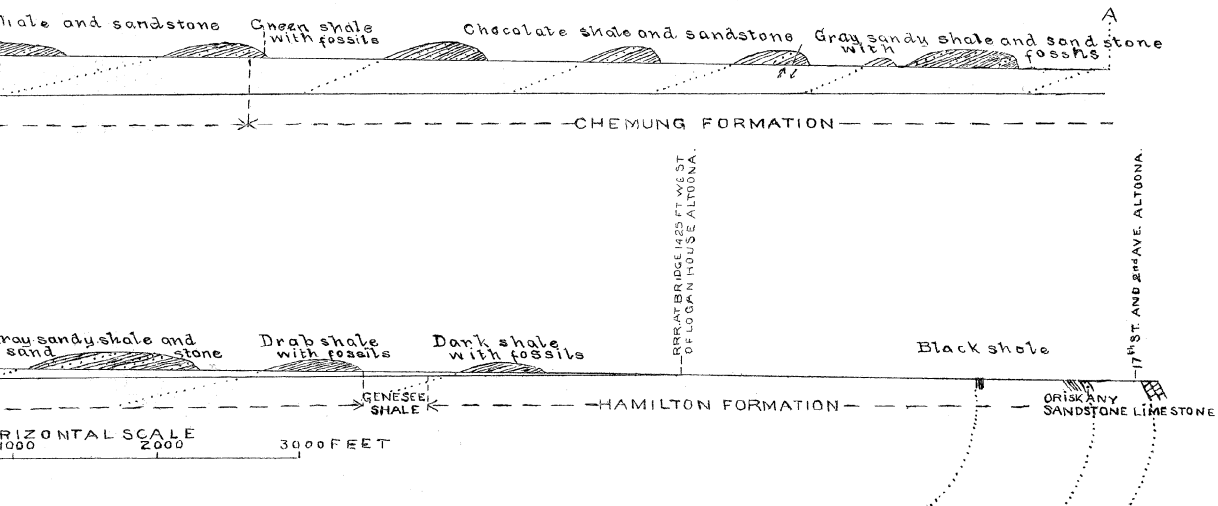


FIG. 2

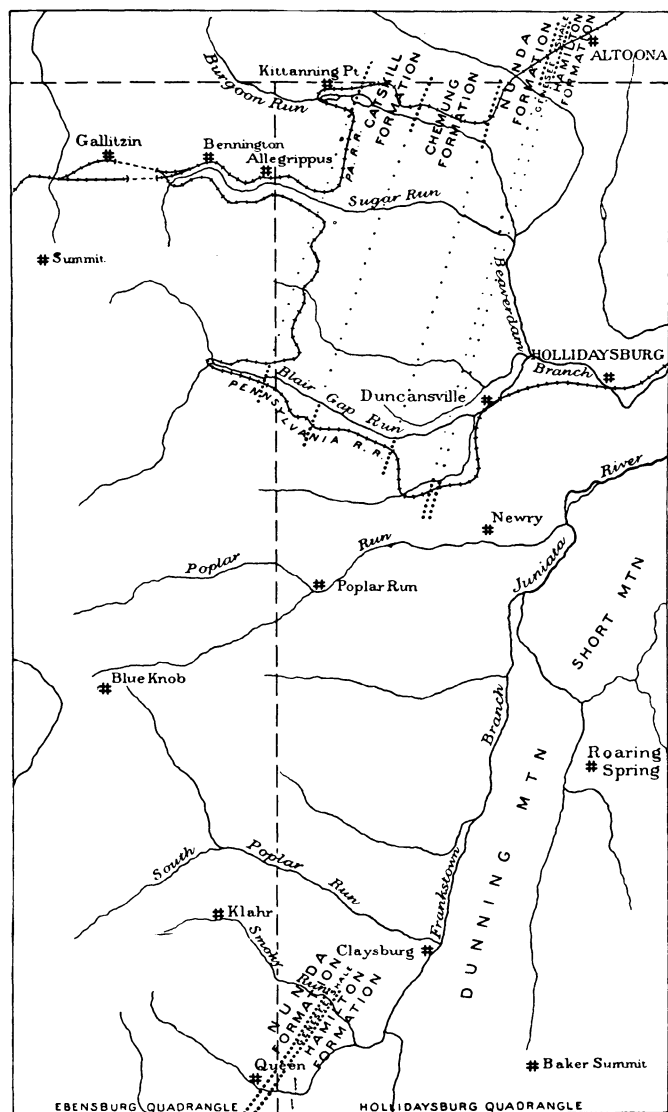


FIG. 3

micaceous shale. Bands of fine-grained, bluish sandstone occur, but they are infrequent and rarely a foot thick. These sandstone layers are often very uniform in thickness, and are divided by joint-

ing into regular prismatic blocks of very characteristic appearance. The bottom of the formation has not been definitely determined in the region; the top is well marked by the Genesee shale, and has been located within narrow limits from the vicinity of Bellwood, on the Pennsylvania Railroad, 6 miles northeast of Altoona, to Quenn, about 20 miles southwest of Altoona. In a railroad cut at a point 1 mile southwest of Bellwood, where the present main tracks of the



FIG. 4

Pennsylvania Railroad diverge from the old tracks, the contact between the Hamilton and Genesee is well exposed. The topmost layer of the Hamilton is an impure limestone, 2 to 4 feet thick, crowded with Hamilton fossils, and immediately overlying it is the characteristic black Genesee shale. At Altoona the contact is not exposed, but its position can be closely determined. On the Pennsylvania Railroad track, beginning about 2,375 feet west of the Logan Hotel and just west of the underground crossing of the electric road to Hollidaysburg, is an exposure extending along the track westward for 540 feet, as shown in Fig. 2. Hamilton fossils were found in



these rocks practically to the top. Fig. 5 is a photograph of the shale in this exposure. West of the above-mentioned exposure is a concealed space of 630 feet, to the point where Twenty-first Street intersects the track. At this point is the beginning of an outcrop of rocks bearing a *Nunda fanua* throughout. At the intersection of Fourteenth Street and Thirteenth Avenue in Altoona the Genesee shale is exposed with overlying shale identical in character and fossils with that at the base of the outcrop beginning on the railroad



FIG. 5

track at Twenty-first Street, as mentioned above. At the above-described street intersection the Genesee shale is at least 80 feet thick, and the strike of the rocks is such as to carry it through the concealed space along the railroad already described. The thickness of rocks in this space is about 140 feet, and deducting 80 feet leaves 50 feet of Hamilton rocks at the bottom of the concealed space. This would extend the Hamilton formation 230 feet beyond the western end of the first cut west of Altoona Station, so that its top would lie about 2,600 feet west of the Logan Hotel along the track.

On the New Portage Branch of the Pennsylvania Railroad the contact of the Hamilton and Genesee shale can be closely located about 1 mile northwest of Newry, where fragments of limestone full of Hamilton fossils were found at the base of an outcrop of the Genesee black shale. The same contact is well exposed in the road between Claysburg and Queen on the crest of a spur  $\frac{1}{2}$  mile northeast of Smoky Run. At this point also a thin, impure limestone with Hamilton fossils occurs at the base of the black shale. The thickness of the Hamilton can be determined only approximately, since in none of the sections studied could the bottom be determined, nor were there a sufficient number of exposures to afford a reliable determination of the average dip. In Altoona the upper part of the formation is exposed, as already described. The dip of this part is  $52^{\circ}$  to the northwest. At the corner of Fifteenth Street and Sixth Avenue the black shale of the formation was exposed in excavating for the foundation of a schoolhouse. The shale at this point is vertical, as shown on the profile section. It is possible that nearer the bottom of the formation in Altoona the shale is overturned. From the meager data at hand it seems that the average dip of  $70^{\circ}$  to the northwest would be a probable estimate for the formation, assuming that there are no faults or strong variations of dip. The distance between the Oriskany sandstone in the southeast part of Altoona and the bottom of the Genesee shale at Fourteenth Street and Thirteenth Avenue, described above, is, by the city map, about 3,300 feet, normal to the strike of the rocks. This space is occupied by the Hamilton and Marcellus formations in which the broad Logan Valley has been eroded. Calculating from the width of the outcrop and the assumed dip of  $70^{\circ}$ , the result is 3,100 feet for the thickness of the Hamilton and Marcellus in the Altoona section.

*Genesee shale.*—This is a well-defined stratum of black clay shale lying conformably between the Hamilton formation below and the Nunda formation above, and on account of its distinctive character it is important as a horizon-marker in the region. The shale is very fissile, cleaving easily into thin plates and flakes. Its black color is probably due to the presence of carbonaceous matter, as in the type region of western New York. As in the type region, it also contains rather plentiful calcareous concretions. Indeed, the formation pre-

serves to a remarkable degree the characteristics by which it is distinguished in western New York. As already stated in the description of the Hamilton formation, the Genesee shale has been seen between Bellwood and Altoona, at the intersection of Fourteenth Street and Thirteenth Avenue in the latter place, on the New Portage Railroad 1 mile northwest of Newry, on the road midway between Claysburg and Queen, and near Queen. It crosses the Pennsylvania Railroad in the concealed space between a point 2,375 feet west of the Logan Hotel and Twenty-first Street. At the above mentioned street intersection in Altoona a thickness of 80 feet was measured, and, as the base of the shale was apparently not exposed, its thickness may be greater. The upper part of the formation is exposed in the bank of Beaverdam Creek,  $\frac{1}{4}$  mile southeast of Queen, and its full thickness at this point is about 75 feet.

*Nunda formation.*—This formation has been known in the previous reports on the geology of Pennsylvania as the Portage. According to the usage of the U. S. Geological Survey, however, the term "Portage" should be restricted to the Portage sandstone of the Genesee River section in New York, and the term "Nunda," which was introduced in the early New York reports, applied to the rocks generally designated the Portage group or beds.

The basal 100 or 200 feet of the Nunda formation are composed of soft pale brown clay shale, which weathers to a dove color and has a very perfect cleavage, splitting easily into large, thin, smooth plates. In this shale *Paracadium doris* and *Pterochaenia fragilis* are relatively abundant and come in immediately above the Genesee shale. In passing upward through the formation, the rocks gradually change from the shale above described to a pale greenish-gray sandy shale which makes up the greater part of the formation. This shale generally cleaves easily into thin laminae, but there are beds of coarser character and less perfect cleavage. Evenly bedded layers of hard, bluish, fine-grained sandstone occur, and some thin irregular layers. These layers are generally from 1 to 6 inches thick, and rarely 1 foot. They are especially abundant through the 100 feet of strata beginning about 350 feet above the base of the formation, and are well exhibited on the Pennsylvania Railroad in the third cut about 1 mile west of the station at Altoona. (See Figs. 6 and 7.)

The peculiar dimpling of the bedding surfaces shown in Fig. 7 is said to be characteristic of the Nunda beds in New York. In the fourth cut, 7,750 feet west of the station, a few bands up to 1 foot thick of compact or shaly, chocolate-colored rock occur, and similar rock is exposed in a cut along the incline No. 10 on the old Portage Railroad. These layers may be the attenuated representatives of the Oneonta phase of sedimentation in eastern New York. The



FIG. 6

thickness of the formation measured along the Pennsylvania Railroad appears to be about 1,400 feet.

In Blair County the bottom of the Nunda formation is sharply marked by the top of the Genesee shale. The top of the formation is, however, very indefinite. No persistent and easily recognized stratum separates the Nunda from the succeeding Chemung formation, nor is there any distinct lithologic change to mark the boundary. The rocks of the one merge into those of the other by imperceptible stages. The boundary, as established by the writers, rests on a paleontologic basis. All the beds above the Genesee, and below the horizon at

which the lowest Chemung fossils are found, are here considered to be Nunda. On the Pennsylvania Railroad this point is about  $2\frac{1}{2}$  miles west of the Logan House, Altoona, in a cut near the beginning of the curve at which, in going westward, the track turns into the



FIG. 7

valley of Burgoon Run. In this cut is a thin band of sandstone, full of *Leiorhynchus Mesacostale* and *Productella lachrymosa*, or a closely allied form. Under the fossil-bearing band nearly 100 feet of rocks are exposed, but no fossils could be found in them. On the New Portage Railroad the lowest Chemung fossils found were the same

as mentioned above, and these occur in a cut about  $1\frac{1}{2}$  miles southwest of Duncansville where the recently constructed branch of the Pennsylvania Railroad diverges from the course of the old Portage Road. (See Fig. 3.) East of this point also are almost continuous exposures of the underlying rock for a thickness of many hundred feet, but no Chemung fossils could be found. No effort was made to trace this boundary farther to the southwest.

*Chemung formation.*—The Chemung formation follows conform-



FIG. 8

ably upon the Nunda to which it is, in its lower part, very similar in lithologic character, but from which it is sharply distinguished throughout by paleontologic characteristics. As stated in the description of the railroad section above, the lower limit of this formation is placed at the lowest horizon at which Chemung fossils are found. Its upper limit is the bottom of the distinctly differentiated rocks of the Catskill formation. As shown on the profile section, the formation outcrops for 1 mile along the Pennsylvania Railroad, its bottom being about  $2\frac{1}{2}$  miles and its top  $3\frac{1}{2}$  miles west of Altoona. Fig. 8

shows the character of the Chemung rocks about 3 miles west of Altoona, and also the fault mentioned on p 624.

The total thickness of this formation in the section just described is over 2,500 feet. In the lower 1,400 feet the rocks are gray or green, sandy or clay shale, with a small proportion of gray sandstone, generally in thin layers in the shale, but occasionally in a stratum 50 feet thick; in the upper 1,000 feet the rocks are charac-



FIG. 9

terized by a large proportion of chocolate shale and by thin layers of chocolate sandstone.

Fossils occur in the topmost layers of the Chemung within a few feet of the bright red shale and sandstone of the Catskill formation.

*Catskill formation.*—This formation overlies the Chemung conformably. The top of the Catskill cannot be very definitely determined in the railroad section. The red shale shown in the profile section about 1,400 feet east of Kittanning Point probably is not far from the top, since it is apparently followed above by prevailingly gray shale and sandstone of the Pocono formation at the base of the

Carboniferous System. The Catskill formation is about 2,000 feet thick. Probably 80 per cent. of its rocks are red shale and red or brown sandstone, the rest of the formation being gray or green shale or sandstone. The red shale predominates. It is mainly argillaceous and is bright red in outcrop; the red sandstone generally weathers to a gray or dull brown color, and shows its true color only on a newly broken surface. The sandstone is medium- to fine-grained, and may be thick- or thin-bedded or even laminated. It generally occurs in thin layers or strata interbedded with shale, but may occur in thick-bedded strata having a thickness of 50 feet. No fossils were found in the formation, and their absence as well as the red coloration sharply distinguishes it from the Chemung. Fig. 9 is a photograph showing the contact of the Catskill red shale with the overlying Pocono sandstone at the curve about 1 mile south of Kittanning Point, where the Pennsylvania Railroad turns westward into the gorge of Sugar Run. (See Fig. 3.)